FORESTS AND WASTE LANDS (IRELAND).

RETURN to an Order of the Honourable The House of Commons, dated 7 February 1884;—*for*,

COPY "of the REPORT of Mr. *D. Howitz*, Forest Conservator, on the RE-AFFORESTING of WASTE LANDS in *Ireland*; and the Application of Forestry to the Remedy of the destructive Torrents and Floods of the Catchment Basins of the chief Rivers of *Ireland*."

A PRELIMINARY REPORT on the RE-AFFORESTING, &c., of IRELAND, by *D. Howitz*, Forest Conservator; with Appendix.

18, Steen Blichers Vei, Frederiksberg,
Copenhagen, 8 January 1884.

Sir,

I HAVE hereby the honour to forward to you my report on the Re-afforesting of Ireland, which you have requested me to furnish you with. According to your wish I came to Ireland and examined the various parts of the country where the want of forest appears the greatest, and a scheme for re-afforesting is most urgently required, and having been informed of the periodical inundations occurring in the Lough Neagh catchment basin, and that the Government had taken steps to prevent these by undertaking series of engineering works, I paid a longer visit to this locality, and examined it closely, to enable me to form a plan for the cultivation of the surrounding highlands and slopes, a work which, if carried out according to the plan hereafter described, is bound to prevent the sudden and disastrous floods, and at the same time furnish the watercourses with water in the dry summer months; not only water enough for the use of the people, but enough for the continuation of water transport, as well as the great advantage that no stagnant swamps or drying flats will be permitted to exhale unhealthy miasmas during the hot summer, an end which no amount of the most skilled engineering will be able to accomplish.

If the cultivation of this comparatively small district is carried out properly, and the great advantages derived from forest culture thus practically demonstrated close at hand, I have no doubt but that the rest of the country will follow in the wake, and the beginning be made to a great and beneficial work, for which posterity will be grateful.

The proper proportion of forest-covered land to the non-forested part of a country is a question which of late has taken a very prominent place amongst the administrative questions in most civilised countries, and particularly where the proper balance has been disturbed by the destruction of the forest. Without entering further upon this theme, I will only refer you to France, Switzerland, Spain, Sicily, and many others, where now the work of cultivating the denuded ranges and hills has been commenced with more or less vigour, and the importance of the question thus recognised. In Switzerland, where the floods in spring, the ravines and falls of earth from denuded mountain sides some 10 years ago attracted so much attention that a commission was formed to inquire into the matter, which resulted in the new forest laws for Switzerland, dated 24th March 1876, I think that you will find some points which can be useful to us. These forest regulations were formed from the French regulations regarding the forests on the mountains of France, where the protection and cultivation of forest was found necessary to prevent floods and climatic disturbances, as hailstorms, &c. I think, therefore, that these regulations may aid in the formation of regulations for Ireland, taking notice, of course, of the difference in climate and other conditions of life between the two countries.

There can no longer be any doubt that the forests on the ranges prevent sudden floods to a very great extent, and that by a judicious cultivation of slopes and high plateaus, in a few years these calamities are avoided. Experience has also proved that such cultivations ensure a steady flow of water during summer, and that the fertility of the agricultural lowlands is increased considerably by them. Baron von Mueller, the celebrated botanist, in his work on forest plantation, states that in forest-bare countries the productiveness of cereal fields increased 50 per cent. by the cultivation of forest belts, a statement never yet contradicted by experience. Where, as in Ireland, the hills and ranges once have been covered with great, and, according to history, valuable woods (the traces of which are to be found everywhere in the bogs), and where it should be so easy to rear the most valuable timber trees, there the work of re-afforesting will not only be a boon to the country at large, by preventing the flooding of the lowlands during heavy rains, and fertilizing them by a steady flow of water throughout the year, making the climate more congenial and healthy, but it will have the great advantage of being a work eminently remunerative, an advantage it will have compared to the difficult and costly cultivation in the Alps, the Pyrenees, and the Ardennes, where only the hardy and cheap trees can be reared, and on which works the French, Spanish, and Swiss Governments are spending millions of money yearly. That the planting of trees of even inferior quality will repay the trouble, and thereby improve comparatively valueless land, you will grant when I refer you to the cultivation of "*Les Landes*" in France. These localities, although so widely different from Ireland, are still a proof of what forest plantation can do. The committee which reported in 1857 on this work, predicted that the cultivation of the "*Landes*," the low-lying lands near the Garonne, would add more than 1,000,000,000 francs to the wealth of France, a prophecy which at that time was regarded as wild and foolish, but which has been more than fulfilled. I will only quote the last words of the late report furnished by the council to the *Departement des Forêts* in 1882:—"This is one of the most beautiful pages in the history of civilization and progress; in a region which, 30 years ago, was one of the poorest and most miserable in France, but which may now be ranked amongst the wealthy and prosperous."

There is at the present time about 1½ million of acres of pine (*Pinus maritima*) on the "*Landes*," and though the soil is of the poorest description, these trees have grown fairly well. Where 30 years ago a few thousand poor and unhealthy shepherds were walking about on stilts to raise themselves above the unwholesome flats, watching their flocks feeding on the scant herbage found here and there, are now villages with sawmills, wood-working factories, charcoal kilns, turpentine distilleries, and for more than 70 miles are seen these vast forests interspersed with fertile agricultural lands, where farmers and foresters by the thousands are finding a healthy and prosperous existence. While here the poor and despised timber of the maritime pine can furnish such results, what can not be done with the humid and rich soil on the hills and ranges of Ireland, where the best and most costly timber trees of America and Europe should find a congenial home?

The products of the forest cannot stand a long and costly transport, and particularly the larger and more valuable assortments for buildings, wharves, and shipbuilding, without raising the price in a very inproportionate degree.

As England now is the greatest consumer of timber and wood in Europe, it is evident that the proximity of the greatest market must raise the value of the product in the forests of Ireland. According to the Swedish "Tidskrift för Skogshashålning, 1881, Upsala," the consumption of wood for the years 1872—1878 gave the following mean importation, as follows:—

England imported yearly	290,000,000	cubic feet.
France	70,000,000	,,
Germany	40,000,000	,,
U.S. of America	25,000,000	,,
Holland	20,000,000	,,
Belgium	18,000,000	,,
Denmark	14,000,000	,,
Spain	12,000,000	,,
Australia	5,000,000	,,

And if the yearly reports are examined we find that the importation of wood to London has increased from four to five per cent. from 1875—1878, and also that there is an increase in all markets, notwithstanding the greater use of iron, coal, and peat as surrogates for wood. The importation to England consists of 36 per cent. of timber for buildings, and of large dimensions, 55 per cent. of split and sawn timber, 5 per cent. of coopers' wood, and 6 per cent. of exotic timber for furniture and articles of luxury. The large consumption of split and sawn timber gives a key for what we should cultivate in Ireland, while at the same time the possibility of producing the larger dimensions at a smaller price might increase the consumption. As now the Norwegian forests have ceased to export, and timber from the Swedish forests is being depreciated with every year, as the necessity for cutting the young, the immature, and the poor forest is growing greater; also looking to the fact that Germany can scarcely supply its own markets, and the exportation of timber from the Baltic soon will cease altogether, then we arrive at the question: "Where shall we get the necessary wood from, and will the cessation of the production of timber from these sources not cause a timber famine?" That there soon will arrive a time when the price of wood, and particularly of matured and large timber, will rise to an extraordinary degree; of this there can be no doubt, but it is said there are in "Russia" still such vast, nearly virgin forests, that these for a very long while will be able to satisfy the present as well as the increased demand. Mr. Herbert's report shows the reverse, and the distance of that country, and the great difficulties of transport there, are bound to increase the price of the timber to such a degree that a producer of the same timber in a country like Ireland, with all its facilities for transport, could almost demand his own price, and take his own convenience for felling and selling.

The greatly increased demand for telegraph poles, sleepers, pit props, &c., &c., mainly supplied by the pine forest, for the growing of which Ireland in particular seems extraordinarily well suited, points directly to which kind of trees to choose. While, therefore, the great bulk of the forests of Ireland should be grown with pines and other conifers in the sheltered lowlands, along watercourses, and near the sea, a great number of valuable deciduous trees might be grown, as well as on the firelines, which must divide the forest and prevent any large conflagration, although in such a humid climate as that of Ireland this danger is less imminent than in the more southern and warmer countries.

Of the 20 million acres of Ireland about one quarter is well suited for forest cultivation, a percentage not at all too great. All the ranges and bogs, all the barren and desolate coastlands, and a great many of the very poor grasslands, are natural forest, and should be made such. Many hundreds of thousands of acres do not pay an interest of 6*d*. a year, and the greatest part of the five millions of acres are waste ground, and pay not 1*d*. There is much grassland and many fenced paddocks on the ranges where the heather and brake is in such force, and where rocks, stones, &c., cover the ground to such an extent that the actual gain per acre is not more than 1 *s*. to 2*s*. Would it not be better to cultivate these vast areas, so eminently suited for forest, and to obtain a yearly rental of at the least 1 *l*. per acre instead? The calculation is easily made, and without entering upon details, which would be out of place here. Cultivation, including cost of nurseries, purchase of seed, preparation of ground, purchase of tools and buildings, fencing, labour, and superintendence, should for, say, 100,000 acres, be about 4 *l*. per acre, or 400,000 *l*.

This first cost, calculated with 4 per cent. interest for 30 years, 17 *l*. per acre add to this expense for superintendence, road-making and repairing, maintenance of fences and drains, as well as all incidental expenses, made up as follows:—

	£.
First cost after 30 years - - - - - - -	1,700,000
1 superintendent at 500 *l*. a year - - - - - - 50 forest rangers at 50 *l*. to 75 *l*. a year - - - - Repairs of buildings, tools, &c., at 300 *l*. - - - -	125,000
Road-making and repairing - - - - - - - Fences, drains, and incidental expenses - - - - -	35,000
	£. 1,860,000

And to put the expenses with a round sum to two millions, the cost per acre will be at 30 years of age 20 *l.*, this, allowing for the highest wages, and I firmly believe that the expenses will be 25 per cent. less.

A pine forest should at that age, under the present conditions of soil and climate, and at the ruling market prices, which are bound to rise considerably in 30 years, be worth at least 50 *l.* per acre all round. I have here not allowed for the small wood obtained by the thinning out of the growing forest, nor for any bi-products obtained during the 30 years, and still the return should not be less than 1 *l.* per acre per annum, an estimate which is by no means too high. Some of the Scotch foresters agree with me that 1 *l.* per acre is not too high; and when we consider that in Ireland can be grown far more valuable timber trees than in Scotland or England, and that the opportunities for transport are so many and so easy there, I arrive at the conclusion that the result may be more than doubled. There are no great difficulties for cultivation in any part of Ireland, as far as I have been able to see, not even on the storm-blown ranges on the west coast. The wind will there, undoubtedly, keep the forest down for a long while, and the outer belt will be of no great value for utilization, but bye-and-by the forest will gain the mastery, and if the protection of the outer belt is kept permanent and intact, inside this the now barren hills will in less than half a century have become valuable forest, and through the protecting influence of these forests the meagre inland grasslands and poor fields will have become fertile, rich meadows, and highly productive cereal fields. The question of the re-afforesting of Ireland must, therefore, to every experienced man appear a question of life and death to the country, and with the facilities as yet in existence, but which, by exposure to the climatic and other influences, may change and disappear, with the consideration that by clothing the hills and ranges the disasters from floods and droughts may be avoided, and last, but not least, the consideration that "it will pay," I consider it of the very greatest importance to commence the work as soon as possible. Every year wasted is a great loss, for with every year the soil loses some of its present suitability, and with every year the complications and difficulties for extended cultivation grow apace, time is lost, and money. By re-afforesting of Ireland, at present fast depreciating in value and fertility with every year, the whole country will be made fertile, prosperous, and, in consequence thereof, peaceful.

The question is now how to commence and carry out the scheme of re-afforesting, and to do so in a progressive way, but at the same time to commence all over the country. A rough estimate gives about 3,000,000 acres as the area which should be cultivated first, and mainly distributed on the north, west, and south-west, in a three fourth circle of the form of a **C**, while the great river basins of the Shannon, Lough Neagh, Blackwater, Barrow, and a number of less significant basins, would require, perhaps, another million or more for forest purposes to regulate the flow of the water. As the treatment of these basins should be very similar, I have taken only one in hand, viz., the Lough Neagh, being the second in importance and size, and having of late years attracted so much attention by the skilled engineering works executed there to prevent the destruction by the sudden flooding of the low lands, works which I feel convinced of will never be able to prevent disasters, or fully to deal with the flood-waters. No engineering work will ever be able to do it. The real cause, the denudation of the slopes and ranges of the whole catchment basin must be removed before any real good can be done, as experience shows at the Rhone, in France, and other rivers, where expensive engineering works have utterly failed in stemming the mountain torrents, or preventing them from flooding the valleys and lowlands to the destruction of these. There the cultivation of the great slopes and catchment basins, ranges and high mountains, is being carried out, a forest work very difficult, costly, and executed under very harassing circumstances of extremes of heat and cold, sudden rains and long droughts, and great want of earth to plant in. These places have been so long denuded of trees and shrubs that the rain has washed every vestige of fertile earth away, leaving only a small quantity in the crevices, and on the narrow ledges, an experience which should be avoided in Ireland, but which is sure to take place in time if the work of cultivation does not take place before long.

The difficulties in those countries, both the physical and climatic, are so enormous in comparison with those to be met with in Ireland, where the island clime, the proximity of the great ocean current, the Gulf Stream, and the abundance of mould or humus to plant in, as well as the geological formations are all so favourable to forests, that it would be unwise to delay the work till some of these advantageous features shall have disappeared.

Considering the large areas to be cultivated, and all the various social and political circumstances out of my province to deal with, I would therefore recommend that only the Lough Neagh catchment should be cultivated first with about 100,000 acres, the whole of which should be treated as one district, and subjected to one plan, and under the direction of a head forester—a trained theoretical and practical professional forester—who should have the sole charge of the cultivation.

But, at the same time, as the work of covering the denuded hills of this basin, as well as a great part of the Mourne Mountains, with forest, plans for the cultivation of the Shannon and other basins should be prepared, and also a number of smaller trial plantations be commenced in the more difficult highlands and coast areas of Donegal, Leitrim, Sligo, Mayo, Galway, Clare, and Kerry. These trial or experimental plantations should be formed by making a number of small and cheap nurseries easy of approach, but as close to the future plantations as possible, and representing in soil and position, as much as it can be done practically, the whole of the cultivation. For the great bulk of the cultivations flying nurseries will have to be made. Thereby the long and costly transport of the plants is avoided, these are not exposed so long with their bared roots to the influence of the sun and the air, and the cultivator can chose his own time for planting, a circumstance of the greatest importance here, where the climate changes so rapidly from cool to warm, and sudden rains may aid or prevent the work. Lastly, the plants are reared on the same soil and under the same conditions as those which they are to occupy in future. Large and, in consequence, costly nurseries must be avoided in all great cultivations, and where, as in Ireland, it will be so cheap and comparatively easy to fence in small plots on the hillsides in the centre of the future plantations, it would be a great mistake to act otherwise. Another advantage to be derived from this course of action, and one which only those can appreciate who have had to deal with forest plantations in countries where this work is not much known, will be that the inhabitants will be made familiar with the trees and young plants and the treatment they require. A host of planters, young and old, will thus easily be raised, and by a periodical instruction in planting those who wish to earn wages as planters can learn the work and be ready when the great plantations are to take place.

It is, therefore, to the placement and arrangement of these nurseries that we will have to draw the first attention, and when this is done, to make a proper selection of seed for plants to be raised in them suitable to the country and its requirements.

This choice must be made, not only with a view to which trees will grow the quickest and make a show in the shortest time, although this question has a great deal of importance, where the influence on the flood-waters is prominent, but due consideration must be taken to the eventual state of the country when the forest raised is matured, to future local industries and agricultural pursuits, and where minerals and metals in the ranges may require special kinds of trees for their development. Where, for example, the geologists have found ironstone or ironore deposits, the Scotch fir, as well as some of the other conifers yielding a resinous wood, rapidly, and at the same time, furnishing an abundance of timber for props and other mining timber, these trees should be preferred, while other trees providing timber for boat and shipbuilding should be reared in localities where these industries are present, or likely to be present, near navigable and safe firths and lakes. In the attached list of trees which I propose to introduce in Ireland I have therefore remarked, firstly, the soil preferred by each, then the growth and the quality of wood, as well as some of the usages to which each is put to in the countries from whence they come and are suited to, and, lastly, the mode of cultivation, but leaving to a more detailed plan for each locality to choose the specimens suited to it and the proportions in which each shall be grown, a calculation which demands a great deal of local knowledge, and which I have had no opportunity of acquiring as yet.

While commencing at the North of Ireland, I would therefore recommend that such experimental nurseries or plantations should be erected near the following localities, namely:—

Garvagh	in the county of Londonderry.
Buncrana	Donegal.
Barracktown	
Glenties	
Kiltyclogher	Leitrim.
Collanneg	Sligo.
Leaville	
Bangor	Mayo.
Newport	
On Croagh Patrick	
On the Slieve Partry Mountain	
Clifden	Galway.
Cahir	
On the Slieve Boughton Mountains	
Boston	Clare.
Fairy Hill	
Kilrush	
Ardagh	
On the Stack Mountains	Kerry.
Dingle	
On the Iveragh Mountains	
On the Slieve Miskish Mountain	Cork.
Kilmeen	
Cahirflaggan	
On Knockmealdown Mountains	

I have only mentioned these 25 localities as the most desirable places, without taking into consideration that in some parts small plantations of fir and larch do already exist, and I willingly grant that a better and more extensive selection of localities might be made after a more close inspection of the country than that which I have had the opportunity of making. Still I think that this list should receive some consideration as it is made also with a view of being easy of access to inspection by the directing foresters and the public, as well as with the view of larger plantations in these places. You will also see from my list of trees that I propose a great change in the character of the forest from that of the Scotch and English forests; besides, the cultivation of large areas demand a different *modus operandi* from that hitherto pursued in small plantations.

In many places I would also introduce sowing of the seed, a much cheaper and, with some trees, a much more successful way of cultivation, but a way which has not as yet been attempted here. The very fair growth of the Scotch fir and larch in many places here give a good promise, but because these trees grow well it is no reason why more valuable timber trees should not be grown also, as I trust they will.

The nurseries selected at the above localities should be so situated that access to them can easily be had, and while in a not too sheltered position, should neither be in an exposed place, they should be on medium good soil, and care should be taken to have a sufficient supply of water for the summer months. This may in many places be accomplished by excavating a small reservoir, or by placing a dam at the upper end of the nursery. The place should be fenced in with a good fence, sheep, goat, and cattle proof, and a small hut be erected for the caretaker, and a shed for tools, seed, &c. The size of the nursery need not exceed five acres, and may even be smaller, but as these places should be kept as permanent nurseries they should not be too small either.

If a larger paddock could be obtained, the rest of it might be used by the caretaker, and later on be utilised for extension of the nursery if required. The ground should then be tilled by ploughing to a depth of about 12 to 18 inches, and might be cultivated one year with flax, which plant has a good effect on the earth, and also kills weeds and such smaller plants detrimental to the nursery beds. Where much peat and heather, a crop of grass may precede, but such places should be avoided if possible. Next year the beds are made in the usual fashion, and the seed is sown according to directions given by the superintendent. The seedlings will then be planted out in the nursery rows in autumn or next year, and the first larger delivery of plants for the plantations or for distribution be commenced two or three years after the first starting of the nursery,

nursery. If now the whole of the country should be planted, these nurseries would be able to supply a great amount of plants at a very cheap rate, and much valuable experience could be had beforehand. If the 3,000,000 of acres should be cultivated, about 100,000 acres a year should be planted, requiring between three and four hundred millions of plants yearly, and about one-third could be reared in these nurseries, the rest being raised in the flying nurseries. The more valuable timber trees of Western North America should be experimented with here, and there might also be reared a number of ornamental trees for distribution in the country to schools, public institutions, as well as to the population.

If it should now be decided to cultivate the whole available forest land of Ireland, and to commence at once, these nurseries, together with the flying nurseries, furnishing about three or four hundred millions of plants yearly, and about 100,000 acres being cultivated yearly, it would be 30 years before the whole of the three millions of acres were cultivated; but before that time much valuable experience would have been gained, and the value of the work be an established fact, while the country had got confidence in the question, and the first planted forests commenced to yield a steadily increasing supply for local wants, as well as for the requirements of the great markets in England.

The first thing to be done should therefore, after my humble opinion, be to nominate a committee of forestry, with a professional experienced forester as secretary, to examine into the requirements of each special locality while fixing the place for each nursery, and the area to be cultivated. The forest laws should then be framed for the protection of the forest, and with the experience from France and Switzerland, these would not be a great matter of difficulty to men who understand the Irish people. There should then be a central forest department in Dublin, under the guidance of some professional forester, and the work on the Lough Neagh be proceeded with as quickly as possible; firstly, to prevent the floods there; secondly, to gain experience; and thirdly, to gain confidence in the efficiency of the work, without which the rest of the cultivations would be difficult. The 20th Clause of the Tramways Act, 1883, provides that: The planting of trees shall be included amongst the purposes for which money may be advanced by the Board of Works. This I consider a great advantage, and one which may be useful here. It enables private people to cultivate forests on their less valuable land, but at the same time I consider it necessary that the people who wish to do so, act in unison, and follow a proper plan under the guidance of efficient leadership, and this cannot be done otherwise than by placing such work under the supervision of properly trained foresters and a central forest department.

Application of Forestry to the remedy of the Torrents and Floods of the Catchment Basin of Lough Neagh.

I shall now take the liberty of entering more fully on the question of the cultivation of the Lough Neagh Catchment Basin, as a means of preventing the disastrous and destructive floods which of late years have done so much damage in the lowlands of that district.

In visiting the locality, I noticed first that a great deal of the lands on the surrounding hills had of late years been formed into grasslands. The heather, brake, and shrubs, which before covered these slopes, and there formed nearly the only vegetation, and by their roots and lower branchlets, kept the water from rushing to the lower grounds during violent rains, had been removed, and drains had been cut as vertically as possible, following the direction of the fall as much as possible, thereby still more adding to facilitate the swift course of the rain water. The cutting of drains in this way is a great mistake. The water is permitted to rush off too quickly, thereby not only drying the ground too quickly, but also taking with it every vestige of fine and good soil, and thus impoverishing the land more and more. I spoke to several farmers on the subject, and succeeded to make many converts to my opinion on the desirability of a different system of drainage on such sloping ground.

The basin, of which I attach a plan, showing the different planting districts and the catchment basins of which the whole basin is formed, is situated on different formations of granite, lower silurian, limestone, carboniferous and igneous rock, and basalt. The treatment will, therefore, vary slightly, both on the account of the formation, as well as on account of the altitude and easterly or westerly fall, but the whole should be treated as one district, and be under the sole guidance of one forester.

During my examination of the district I obtained from Mr. W. J. O'Neill, a gentleman engaged by the Board of Works as engineer for the works in connection with the Lough Neagh, and who has been occupied here for upwards of 24 years, the following information.

The summer level of the lough is, at the Toome Pier, about 46 feet above the ordinary spring tide at Coleraine. This gives the very small fall of nine inches per mile for the outlet of the waters accumulated in the lough, and in cases of heavy rains, as it has been proved by sad experiences, quite insufficient.

The supply of water to the lake is derived from the following catchment basins:

	Sq. Miles.
The Black Water River basin, with an area of - - -	618½
Main River - - - - - - - - - -	313¾
Upper Bann River - - - - - - - -	208
Ballingderry River - - - - - - - -	161¼
Mozala River - - - - - - - - -	140½
Six-mile River - - - - - - - - -	92
Crumlin River - - - - - - - - -	67¾
Portmore Lough - - - - - - - - -	40¼
Stewart Town River - - - - - - - -	30¼
Closet River - - - - - - - - -	28½
And the Ballygronan River - - - - - - -	11
Total - - -	1,711¾
Lower Bann and Lough Bay - - - - - -	340½
Area of Lough Neagh itself - - - - - - -	153½
Total of Lough Neagh Catchment Basin is therefore - - - - - -	2,205¼

Of the area of the basins discharging water to the Lough Neagh, or about 1,712 square miles, I consider about 400 square miles fit for forest culture, or about 256,000 acres.

The rainfall averages annually about 36 inches, but it has been as much as 21 inches in four months, and on some occasions it has been as much as 1 inch in 24 hours. It is therefore easily seen that an enormous amount of water must be discharged through the lower Bann to prevent the flooding of the lowlands. The Toome Pier discharges about 400,000 cubic feet per minute when the lough is three feet above summer level, and one occasion, when the flood-waters reached six feet above this level, the lower Bann shall have discharged nearly 700,000 cubic feet per minute; but then a great part of the flats must have been submerged already. The annual rainfall being 36 inches, the annual rainfall per acre would be 130,680 cubic feet, or for the 256,000 acres proposed to be cultivated, 33,454,080,000 cubic feet.

Let us presume that the Lower Bann discharges during a heavy rain 700,000 cubic feet per minute, or 1,000,000,000 in 24 hours. If now, as has been the case before, there falls one inch of rain in 24 hours, and it is calculated that at present at least seven-tenths of this reaches the lake in 24 hours, the lake will receive a volume of water of about 2,880,477,000 cubic feet, or the weir will only be able to discharge one-third of the water. But this must be viewed in another light. The main rush of water will occur from the ranges, slopes, and barren hills forming the 256,000 acres calculated for forest culture. The rain falling on these will be heavier than on the lowlands, and about nine-tenths of it will be discharged within the 24 hours, or nearly immediately.

With one inch of rain falling, the volume of water from these 256,000 acres will be close upon the third of the whole amount discharged, viz., 929,280,000 cubic feet, but it is more likely that it is at least 50 per cent. more, for when heavy rains take place, it always rains the heaviest in the ranges, and where these have been maltreated by denuding them of all vegetation and cuttings of drains, as before remarked the rush of water will be even heavier than above stated. That I have some foundation for this statement you will grant when I draw your notice to the following fact:—While the catchment basin of the Blackwater river contains about 618 square miles, and the upper Bann only 208 square miles; the latter, during heavy rains, discharges as much, and more than the first named river, and floods the lower parts much quicker. That the course of the flood-waters is much more violent in the Bann is also easily seen by the torn and waterworn banks of this river. This fact is easily accounted for. The slopes of the Upper Bann basin are much steeper and more barren than the sides of the Blackwater basin, and therefore offer no resistance to the waters rushing down to the lowlands. Having examined the various basins separately, I therefore consider that the areas to be cultivated should be distributed in the following proportion, according to the character of their sides, as well as with a view to the amount which seems suitable and obtainable, the last being of course only a guess on my part, as I had no opportunity of making inquiries about the ownerships, tenant rights, and all those questions which make the cultivation of these localities so intricate and difficult, but which are outside the object of this report, although they are bound to influence the practical execution to a very great extent.

The proportion to be cultivated in the various basins should be the following:

1.	Blackwater basin,	containing	618½	square miles	to be cultivated with about	80 square miles.
2.	Maine River -	,,	313¾	,,	,,	60 ,,
3.	Upper Bann -	,,	208	,,	,,	130 ,,
4.	Ballinderry -	,,	161¼	,,	,,	40 ,,
5.	Mogola - -	,,	140½	,,	,,	30 ,,
6.	Sixmile - -	,,	92	,,	,,	20 ,,
7.	Crumlin - -	,,	67¾	,,	,,	10 ,,
8.	Portmore Lough	,,	40¼	,,	,,	10 ,,
9.	Stewartstown -	,,	30¼	,,	,,	10 ,,
10.	Closet - -	,,	28½	,,	,,	5 ,,
11.	Ballygronan -	,,	11	,,	,,	5 ,,
			1,712	square miles.		400 square miles.

You will perceive that I have given the greatest pertion to the mountainous districts, as well as to the granite formation, and as it seems that the most available land is also in these districts, the matter is so far simplified.

The area of the whole basin being 2,205 square miles, the area for forest purposes 400 square miles, the percentage is about 19 per cent., a proportion not at all too great, and one which it has been found very suitable to the fertility and prosperity of a country. But I seriously doubt if it would be practically possible to obtain more than one-half of this area for the purpose, and will therefore only count upon an area of 100,000 acres, or scarcely 8 per cent. for forest purposes, the very smallest area it would be of any use to cultivate with a view of a practical influence upon the flood-waters. If these 100,000 acres were cultivated, and the principal slopes and hills were covered, I have no doubt but that in a very few years the effect would begin to be felt. The most important basins should, therefore, be occupied by the great bulk of the cultivation, and form the first forest complex of the district. The distribution of the cultures amongst the basins should, therefore, be as follows for 100,000 acres, or 156 square miles:—

	Sq. Miles.
Blackwater Basin - - - - - - - - - - -	30
Maine River - - - - - - - - - - -	20
Upper Bann - - - - - - - - - - -	80
Ballinderry - - - - - - - - - - -	16
The rest - - - - - - - - - - -	10
100,000 Acres - - -	156

This area would then comprise the greatest part of the more important slopes. The 80 square miles of the Upper Bann would naturally be the most important, and furnish in a short while valuable experience both as to the effect of the cultivation on the flood-waters, as well as to the efficiency of the various trees and the ages in which to fell them, and in other respects open the question and attract the notice to similar cases.

The area fixed for cultivation being now about 100,000 acres, this should be divided into five periods of five years each, thereby fixing the time when each should have come to maturity. The forest of the first period will, therefore, be

25 to 30 years old when felled, the second period 30 to 35, and so on, assuming that the whole 100,000 acres were cultivated during the first period of five years. The periods will be so arranged that no large area will come for utilization at one time, and thus no great part of the forest be denuded for trees, and particularly in the Upper Bann this mode of forestry will be observed. The first work to be done will be the exact fixing of the boundaries of the forest, its survey and fencing in, and division of periods. For each part it will be desirable to have a permanent nursery, and I propose to erect such in the following places on the principles described before:—

Blackwater Basin	Emyvale and Tullycarbet	Eight permanent nurseries.
Upper Bann	Hilltown and Dromara	
Crumlin, &c.	Caramoney	
Maine River	Sleemish and Newtown	
Mozola	Maghera	

The ground in these permanent nurseries to be tilled and treated in the usual way, and a number of trees planted immediately, to give a congenial shelter for the young plants. The plants to be reared in these nurseries should be of the more important timber trees, and be used mainly to fill up gaps in the cultivations, and where suitable places in the forest give an opportunity of rearing these. The accent should, therefore, be laid on trees suitable to each locality and formation. The nurseries to the south-west, west, and north-west of the longh, should be calculated to rear plants preferring a limestone formation, and with a view of furnishing mostly a local supply of timber for small farmhusbandry and firewood, as well as the increasing demand for sleepers and telegraph poles, besides covering the slopes and bogs. A good many useful avenue trees might also be reared here for distribution in the country. The list of trees attached will supply the necessary information as to the trees to be chosen, and the proportion in which each specie to be reared will be decided when the locality is finally examined and the periods fixed. The nurseries to the east might not only contain the quicker growing and less valuable timber trees, but also timber trees suitable for transport to the adjacent coast, and for other purposes, while the nurseries in the Upper Bann should only contain the most valuable mountain timber trees, as well as a stock of common firs, and more hardy trees for filling up gaps.

The forest of the Upper Bann must be reared with the two important views of covering the slopes with a "dense" forest, and to rear trees suitable for the markets, the local supply being of a secondary importance.

The forest being fixed, and the nurseries placed, the periods are arranged on the following principles. First, to make them as equal as possible not only in size, but mainly in productiveness; and to keep the forest as constantly closed as possible even when the periodical utilisation takes place. It is also most important to place the periods in such a way that access to each is easy without having to pass over a younger period, and roads and tracks on which to carry away the forest produce of each period must be well considered by the experienced forester laying the plan for this part of the scheme.

The periods having been fixed on the maps as well as in the forest, a series of flying nurseries is established to provide the great bulk of plants for each. These nurseries are small, and situated in a central position, fenced by a cheap moveable fence, and only used for a few years. In these are raised the necessary plants to supply the whole of the neighbouring part of the period, but they may also be used during the following years to supply the succeeding periods, if practical. The preliminary work for this district of the Lough Neagh would therefore occupy a couple of years before the planting of the first period could take place, and it would be five years more before the whole of the complex was cultivated, even if sowing on the high plateaus with birch was resorted to. But even then in less than 15 years the effect would be felt and valuable experience gained.

If now this forest complex, containing the area of 100,000 acres, exclusive of area for roads and fences, water-courses, ditches, drains, rocks, quarries, and other unproductive parts of the forest but within the boundaries, is considered, and to it be added the cost of the nurseries and all expenses in connection with the forest, let us make a rough estimate of the whole cost and its value per acre when the first part of the forest should commence to give a return for the outlay, a return which will increase with every year as the volume of wood per acre increases and the more valuable timber comes to maturity. The value of the land I do not include in the calculation, as the appropriation of it is outside the district of this report; besides, it is so small that it only in a very few cases can enter as an important factor in the calculation.

Eight nurseries of five acres each, tilled, fenced, with water-reservoir, house or hut, shed, gates, tools, and all other appurtenances at 750 *l.* - - - - - - -	£. 6,000
Fencing of the forest, which in most cases here is already fenced, gates, &c. - - - - - - - - -	4,000
	£. 10,000

This 10,000 *l.* must be looked upon as a capital invested and returnable before the end of the 25 years, and can therefore enter into the expenditure only with a yearly interest of not more than 750 *l.*

	£.
The yearly expenditure will therefore be - - - -	750
20 flying nurseries at 25 *l.* - - - - - - -	500
50 caretakers at 50 *l.* - - - - - - - -	2,500
Eight skilled nurserymen at 100 *l.* - - - - - -	800
Labour at tilling, fencing, planting, sowing in nurseries, and preparing plants for planting - - - - - -	1,000
Superintendence, surveying, maps, plans, tools, travelling expenses - - - - - - - -	1,450
	£. 7,000

First cost of preparing ground for and planting or sowing on 20,000 acres, 2 *l.* per acre - - - - - - -	40,000

The value of this money in 25 years is about 325,000 *l.*, and even if to these were added 25,000 *l.* for incidental expenses, the value of the expenditure per acre would not be more than 17 *l.* 5 *s.*

Let us now contemplate that the first planted forest suffers a great deal, and is not worth more than 40 *l.* per acre, still there is a good surplus.

The first crop is very rarely of great value in a forest, particularly where new ground has been cultivated. It seems as if the soil and the locality should be seasoned, and the first trees prepare the ground for the succeeding vegetation, before good results can be looked forward to. This should be known to all forest-growing landowners, as they may think that a wrong specie had been chosen when the first crop showed bad, and it may even be that this was the sign that the following crop would be so much better. With every year the value of the forest will increase in a much larger ratio than the value of the expenditure, until the culmination point of growth has been reached, and the forest is mature for felling.

If now the Government should decide not to undertake the cultivation, but the country itself engage on this work, still I think that you will agree with me that a combined plan is necessary, and that the Government who has agreed to advance the money, must for its own protection establish a forest department. This department should then prepare the cultivation plans, and control the work, as well as prepare the necessary laws and regulations, but without such a central administration the whole of the forests will be useless, planless, and unprofitable in every direction.

I have not here entered into any details for the work, as it was impossible for me to do so without more exact dates to go by, but I trust that I have entered enough upon the matter to show you how profitable in all directions this work of re-afforesting Ireland would be, profitable to the country, to England, and to the world at large.

This Report may now briefly be stated to contain the following points:

1. Appointment of a committee of inquiry, with a skilled scientific forester as secretary.
2. Selection of nurseries.
3. Surveying of forest areas, and laying of detailed cultivation plans for the Lough Neagh Catchment Basin; and
4. List of trees to be introduced.

I beg now to conclude in the sincere hope that this Report may be acted upon, that a country so eminently suited to the possession of these great blessings—vast forests—may be enabled, through the wise actions of a Liberal Government, to enjoy them. We never see truly happier homes of unmingled contentedness than in the seclusion of the forests, where the bracing purity of the air, the freedom from formal restraint, and the healthy work and occupations give to life a charm which we do not find elsewhere. There are but few human works which are so unselfish and noble as the planting of forests, and where, as in Ireland, such great and valuable forests have once existed, the re-afforesting of it is only a payment of a debt due to posterity.

I have, &c.
(signed) *D. Howitz*,
Forest Conservator.

R. S. D. Lyons, Esq.,
Member of the Parliament for Dublin.

APPENDIX.

FOREST-TREES, which I propose to cultivate in *Ireland*, with a few Remarks on their general Character, Habits, Utilization, and Cultivation.

The trees which will form the first and important part in the re-afforesting of Ireland will be the conifers, and of these the most important will be the

PINES.

(Ranges) -	1. *Pinus Silvestris.* Linné.—The Scotch fir. No remarks are here necessary on this well-known forest tree, and its adaptability for forming beginning forests in even exposed position here.
(Shelter-belts) E.	2. *Pinus Austriaca.* L.—The Austrian fir. A hardy tree easily reared on very poor soil, and in most exposed positions. It is eminently suitable for shelter planting on sandy, rocky, and very poor soil. One of the benefits derived from the cultivation of this tree is that the fall of its leaves or needles is so great that the soil is highly fertilised by it. The wood is light and fissile, and of no great value as timber, but it gives excellent charcoal. The plants reared in the flying nurseries should be two years in the nursery lines before planting out in exposed positions, and should, in shelter belts, be planted very close, so as to form a compact resistance to the wind in a short while.
(Shelter-belts), W.	3. *Pinus Contorta.* Douglas.—Is found on the high and damp ranges of Western North America. Being a mountain tree it is well suited for clothing the western ranges of Ireland, and as it bears exposure should occupy a prominent place here. The wood is somewhat darker than that of the Scotch fir, more resinous, but rarely reaching large dimensions, the height not exceeding 50 feet, the timber never furnishes more valuable sortiments. The position which this tree is to occupy demands planting, and in mixture with *P. Austriaca* might be very useful as nursetree.
(Mountains) -	4. *Pinus Cembra.* Linné.—Also a mountain pine; preferring a rocky soil, and resisting the wind, though not quite as well as the former. The wood is of a yellowish colour, very soft and resinous, but not of great strength. It is mostly used for indoors-work, and for carving. Height, 120 feet, with diameter in breast height of 4 to 5 feet. The seed is edible, and yields a great quantity of a valuable oil. From this pine is obtained a very good turpentine. This tree is best cultivated in mixture with other quick-growing conifers, and may be sown in sheltered positions, but always planted if occupying in any exposed places.
(Swamps, bogs) -	5. *Pinus Cembroides.* Zuccarini.—Swamp fir. A tree only mentioned here because it will grow so willingly on swampy and boggy peatmoors on the mountains. The wood is of no great value, the tree only attaining a height of 30 to 40 feet. Seed edible. The pitch and turpentine obtained from this tree are the only direct advantages to be derived from the cultivation; still, I think, it should be tried in some of the worst bogs where few other trees will grow, and thus prepare the land for better utilization.
(Mountains) -	6. *Pinus Excelsa.* Wallich.—The Bootam fir of North India, where it forms large forests on the highest mountains in the Himmalaya. A very hardy tree even on poor soil, prefering rocky slopes and undulating ground. Height, 150 feet. Wood very valuable, resinous, close grained, but not very hard, and easy to work, durable, and in the close forest very clean and straight. The bark is used for tanning, and a very valuable turpentine, in great quantity on good soil, is also derived from this tree. This tree should be reared in the large nurseries.

(Mountains) - 7. *Pinus Monticola.* Douglas.—A Californian fir; preferring rocky ranges, but not a too exposed position. Height, 100 feet. Wood durable, white, firm and yielding, most useful building timber. Several fine specimens in the Dublin Botanic Garden show a good growth, but should, in a forest, be grown very close. For cultivation on the Mourne Mountains this tree should play a prominent part.

(Medium) - 8. *Pinus Laricio.* Poirct.—The Corsican fir; prefers limestone, but will also grow on sandy soil. Height, 120 feet. Wood white, fine, dark towards the centre, resinous, elastic, and durable. Used much for waterworks. This tree should be extensively used on the north and west parts of the Lough Neagh Catchment Basin, and be planted in unison with other conifers acting as nurses.

(Highland rocky) 9. *Pinus Montana.* Du Roi.—An Alpine fir easily reared in the most exposed positions and poorest soil. Height, 25 to 30 feet. Wood white and light, used for carving, and yielding a good charcoal. The pitch and turpentine obtained from this tree is the most valuable, and on this account would be useful on the barren and exposed Highlands. Can both be planted and sown. The variety, *P. pumilio*, with hanging boughs, should be avoided as useless here.

(Bogs) - - 10. *Pinus Nigra.* Aiton.—The black spruce of Canada grows well on swampy ground. Height, 70 feet. Wood, light, elastic, white, and much sought for shipbuilding, yardarms, masts, &c. The black spruce should be easily reared here, and form a valuable forest on the high and boggy plateaus of Ireland, where it should be planted in company with more valuable conifers.

(Flats) - - 11. *Pinus Lambertiana.* Douglas.—The sugar pine of North-west America; prefers a light and sandy soil on undulating ground. It is a lofty tree of rapid growth, reaching in its home a height of 300 feet. Wood soft and white, and even in texture, well suited for all inside work. Yields a clear sweet resin, used sometimes instead of sugar. Seeds edible. On some of the southern parts of Ireland this pine might prove a great boon, and rapidly furnish a farming population, with a great abundance of easily worked wood for flooring, and all kinds of farm housework. The plants should be reared in head nurseries, and not be more than two or three years old, and I have seen very successful plantations of one year old, *P. Lambertiana*, but this would have to be tried first on a small scale.

(Mountains) - 12. *Pinus Ponderosa.* Douglas.—The pitch pine of North-west America; prefers a dry rocky locality, but not too exposed. Should do well on some of the steep slopes of the Mourne Mountains and other ranges. Height, 200 to 300 feet, with diameter of 8 to 12 feet. Wood heavy close-grained, elastic, and very durable, perhaps the most valuable timber of all the pines. Deserves to be introduced largely here, as it would be likely to be of quick growth. In a close and dark forest the wood is remarkably clear and free of knots, and altogether much more valuable than if reared in an open position.

The seed should easily be obtained from California, and be sown in the stationary nurseries, as all the more valuable timber trees. The plants should remain two years in the nursery lines, and be planted in mixture with older larch or Scotch fir acting as nurses.

(Coast) - - 13. *Pinus Radiata.* Don.—The coast pitch pine of California is a tree of no great height, but of remarkably quick growth. The wood is very tough and elastic, and is used for boatbuilding, for which purpose the cultivation on the seacoast recommends it, as it will grow close to the sea, and even where the tide reaches the roots. Easily propogated, but plants should be one to three years in nursery lines before planting on very exposed ground. On less exposed places sowing may be resulted to in rows between other pines.

(Inland plateaus) 14. *Pinus Strobus.* Linné.—The Weymouth fir or white fir of North America formed once large forests in Michigan, &c. (U. S). This tree will grow in almost any soil but salt marsh, and in good and favourable localities attains fine proportions, yielding a most useful wood, of a white, soft, even, and clean texture, not very resinous, durable, and elastic, and used much for building purposes, flooring, &c. Height, 150 feet and more. Diameter, 8 to 10 feet. The large dimensions are used for masts, &c. Easily reared from seed. The plants may be planted young in mixture, with nursing pines of other kinds, but when planted in clean forest of *P. Strobus* should be a couple of years, and should therefore be reared in the flying nurseries where large cultivations of this valuable tree are contemplated. Suitable to most of the hills in Ireland, particularly on the western slopes.

(Rocks) - - 15. *Pinus Rigida.* Miller.—The pitch pine of Virginia; prefers a rocky soil on sloping ground, and yields in such localities a heavy resinous and durable wood, while the wood of the trees reared in light sandy and alluvial soil on the flats is light, not very resinous and not so durable, but easier to work, and yielding better charcoal. Height, 80 feet. This tree will grow in very dry localities, and stand the dry summer and extreme wet winter alike. On the eastern slopes and on granite formations, as well as on some of the western ranges, should do well in mixture with the more valuable, *P. Strobus* or *P. Ponderosa*, which should remain while the *P. Rigida* was taken away in 5th or 6th period.

(Swamps) - - 16. *Pinus Serotina.* Michaux.—The Pond pine of the Southern North America will grow well and fast on boggy, peaty, swamps, and stands the sea air well. It would therefore be well to cultivate on the mountain bogs in Donegal, Mayo, Galway, &c., where it would prepare the ground for higher class forest, while yielding a soft but very useful wood. Height, 50 feet; diameter, 1 to 2 feet. This pine planted on the bogs, the surrounding rocky slopes might be cultivated at the same time with

17. *Pinus Sabiniana.* Douglas.—The Californian white fir in mixture with *P. Ponderosa*, acting as nurses for the latter. The home of this tree is the western slope of the Rocky Mountains, where it grows to a height of 150 feet, yielding a soft white wood useful for farm husbandry. The cones, which were sometimes one foot long, contain a great number of edible seed, germinating readily.

The pines should only in few cases form pure pine forests of one kind, but be grown in mixture, so that the quicker growing kinds and the less valuable would act as nurses. Wherever practicable, firelines of deciduous trees should act as preventatives for extensive forest fires, though in this country, so well favoured with constant moisture, the danger is not so great as in more southern and drier climes. Related to the Pines are the

ABIETINEAE.

(Bogs) - - 18. *Abies Balsamea.* Linné.—The balsam fir, or balm of Gilead, is a North-east American tree, hardy and elegant, but only about 50 to 70 feet high. It prefers swampy ground, and is well suited to join *P. Serotina* in forming beginning forests on the bogs of Ireland. The value, as timber, is not very great, except for local use, but the tree yields the well-known Canada balsam, a valuable article of commerce. Can be planted young, but the two to five years plants are best suited here.

(Highlands) - 19. *Abies Douglassii.* Sabine.—The Oregon pine, called also the yellow fir, from Paget Sound, where it for a long while has furnished the greatest amount of lumber, is one of the most important conifers for the re-afforesting of Ireland, as it seems to be extremely well-suited to the climate and other conditions, and is one of the most valuable timber trees. It requires a deep and good soil as well as sheltered position, but is in such places of rapid growth, yielding a fine, firm, and clean-grained timber suited for masts, yardarms, spars, and large building purposes, as well as furnishing a splendid wood for flooring-boards. It has been known to reach a height of 300 feet with a diameter of 15 feet. The crown is not very large, and it can therefore be grown very close, and thus yield a great amount of wood per acre. This tree may form pure forest on that account, and should be reared in the flying nurseries, where the young plants may remain about two years, and then planted in alternation with larch, which should give room for it after four or five periods.

(High plateaus) - 20. *Abies Nobilis.* Douglas.—The white pine of North-west America. Like the former, it prefers a better locality, reaching a height of 200 feet. The wood is very valuable, light, elastic, and clear-grained when grown in close forest. As an ornamental tree it is very fine, with regular, horizontal branches, but if grown for that purpose, the wood is knotty and not so valuable. Treatment like *A. Douglassii.*

21. *Abies Magnifica.* Murray.—Resembles the latter, but is more hardy.

(Eastern aspects on high plateaus) 22. *Abies Pectinata.* Du Roi.—The noble pine or spruce of Central Europe. A lofty tree, preferring humid, sheltered position, and yielding a very valuable timber; used much for flooring-boards. Is easily propagated from seed, and can stand shade better than any other conifer, and is therefore useful for cultivation as successor to the standing forest. Can be planted very young, but stands transplanting in a high age also.

(Valleys) - - 23. *Abies Mertensiana.* Bongaod.—The hemlock spruce, a valuable timber tree; reaching in sheltered valleys on rocky subsoil a height of 200 feet, with a diameter of 6 feet. Wood white, soft, and easily worked; useful for most building purposes.

(Plateaus) - 24. *Picea Excelsa.* Du Roi.—The Norway spruce. This well-known tree prefers a humid, sheltered slope and calcareous soil, where it reaches a height of 150 feet, furnishing an excellent timber for building purposes. From this tree is obtained, particularly in mountainous districts, the so-called "Burgundy pitch," and the bark is used for tanning. In the inland and northern districts it should form valuable forests near agricultural districts. Can both be planted and sown, but the first forest should be planted from plants one to three years in flying nurseries.

(Exposed positions shelterbelt). Height, 40 to 50 feet. 25. *Picea Alba.* Aiton.—The white spruce of North-west America. Although this tree does not yield a very good or durable wood, it is recommended for cultivation on account of its hardiness, and because it will resist the pressure of the wind even on the most exposed positions, or on very poor soil. It should, therefore, form the outer belt, say for 5 to 10 rows on very exposed ground, and be left there as long as possible to form a permanent shelter-belt for the more valuable forest. Also very hardy, and more valuable is

(Mountains) - Height, 100 to 150 feet. Diameter, 6 to 9 feet. 26. *Picea Sitchensis.* Carrière.—Which will also resist the wind, while it furnishes a far better wood for all practical purposes than *P. Alba.* The shelter-belt might, therefore, be formed of both these trees by gradually passing from pure rows of *P. Alba* to pure rows of *P. Sitchensis,* which in their turn may give way to the more valuable timber trees.

Both these trees can be planted very young, and should be reared in the flying nurseries.

Of *Cupressineæ,* the following are recommended:—

(Limestone hills) 27. *Cupressus Lawsoniana.* Murray.—A tree 100 to 150 feet high, elegant and very valuable. The home of this tree is California, where it prefers calcareous soil, but will grow on very dry soil also. The wood very valuable, white, firm, odorant, durable, and easy to work, used for furniture as well as for inside work in buildings. It is a hardy tree, and bears germinating seed at a very early age. Plants remain a couple years in nursery lines, and when planted out should not be trimmed.

(Mountain bogs) 28. *Cupressus Macrocarpa.* Hartweg.—Also a Californian tree; preferring a granite formation, but will grow well on peat-moors there. Height, 75 to 100 feet; diameter, 3 feet. It is one of the quickest growing conifers, and, as it will not stand great extremes of temperature, should be well suited for cultivation in the south and west of Ireland. The wood resembles the former, and the cultivation is similar.

(Bogs - - 29. *Cupreseus Thuyoides.* Linné.—The white cedar of North America; prefers damp and swampy ground, and might, therefore, be extensively used here. Height, 75 feet; diameter, 3 feet. Wood soft, light, and fragrant, durable, and resisting the influence of water; is much sought for waterworks, &c. Easily propagated, but should be 2 to 5 years in nursery lines, on account of the swampy ground in which it should grow.

(Bogs) - - 30. *Cupressus Nutkaensis.* Spach.—The yellow cedar of North-west America; will grow almost in any soil, the only condition seemingly being moisture, and it is therefore well-suited for the greatest part of Ireland. Height, 100 feet. Wood close-grained, fragrant, tough, and much used for boat-building. Propagated from cuttings and suckers, as well as from seed. Should be reared in the flying nurseries, as well as the former, to form the forests on the boggy slopes of North Ireland, and also on the Mourne mountains bogs.

31. *Thuja*

(Valley bogs) -	31. *Thuja gigantea.* Nuttall.—The yellow cypress of North-West America; prefers also moist ground, and grows in the sheltered valleys to a height of 200 feet, yielding a pale valuable wood used for cabinet-making, as it receives a high polish, and also for all building purposes, and for boat-building, as it is very tough and elastic. The bast is used for ropes. It is easily propagated from seed, and may be planted out very young, but the ground should be well prepared, and it should be cultivated in mixture with nursing larches or Scotch firs.
(Highland moors)	32. *Thuja occidentalis.* Linné.—Called the northern white cedar; prefers also a moist soil. Height, 80 feet. The wood is very resinous, tough, red in colour; used much for waterworks and by wheelwrights, where hardness is required. The bast used for ropes. More hardy than the former, and can also be planted young.
(High plateaus) -	33. *Sequoia gigantea.* Seemann (*Wellingtonea gigantea.* Lindley).—The mammoth tree of California. A mountain tree preferring the deep soil on the high plateaus. Height known to have reached 450 feet, with a diameter of 35 feet. Wood soft, white when felled, but turning a rusty red by exposure to the air. Should be cultivated here as an experiment in close forest, where it may succeed better than as an ornamental tree in the open. It is not difficult to propagate, but should be 2 to 5 years old in nursery lines, and then be planted in mixture with other trees in proportion of 1 to 10, so as to be left to form the forest when the others had disappeared. Best suited to the higher inland plateaus.
(High plateau) -	34. *Sequoia sempervirens.* Endlicher.—The bastard cedar of California; prefers a calcareous soil or sandstone formation, a deep soil, and not too exposed position. A large tree 350 feet high, and known to have reached a diameter of 50 feet. The wood is close-grained, reddish, but light, and not very strong. Used for cheap furniture and building material, charcoal, &c. It has been introduced in several parks in England, where it has succeeded very well. It should be cultivated in Ireland in farming districts on account of the great yield of wood per acre, and like the former.
(Bog) - -	35. *Taxodium distichum.* Richard.—The swamp cypress of Virginia; prefers swampy and boggy highlands, and should receive great attention in planting the bogs. It is a large tree reaching a height of 100 to 150 feet, yielding a most valuable timber, of rapid growth, deciduous, and vastly improving the soil by the great amount of foliage, &c., yearly thrown. The wood is hard, fine-grained, durable, and elastic, and much sought for all kinds of carpenters' work and general farm husbandry. Easily propagated, and furnishes at an early age a great amount of good seed.
(Valleys) - -	36. *Cryptomeria Japonica.* Don.—A Japanese tree of slender proportions, preferring humid, island clime, and furnishing a very white, soft, and very beautiful wood for furniture. It is of rapid growth, and should be used in mixture with slower-growing forest trees to be taken away in the 5th to 7th period. Seed obtainable in Paris.

Of the 36 conifers mentioned here, I would recommend that there should be chosen for each locality a certain number, say at least 5 or 6, suitable to the locality, but that at the same time, as large numbers of plants of these were reared, some of the other kinds also be experimented with.

Though having omitted the larch (*Larix Europea*), I also consider that this tree should be extensively cultivated.

DECIDUOUS AND HARDWOOD TREES.

MAPLES.

(Avenue) - -	1. *Acer Negundo.* Linné.—The box elder, as well as the Californian *A. Negundo Californicum*, should be well adapted for the lowlands, and to line the roads and inclosures with. It prefers a humid and sheltered position. Height, 50 feet. Wood, pale, and rich in saccharine matter. Used for furniture. Can be planted very young.
(Avenue) - -	2. *Acer platanoides.* Linné.—The Norway maple, a shady avenue tree, which should occupy a place here on account of its valuable wood; used by cabinet makers, carpenters, &c.
	3. *Acer pseudoplatanus.* Linné.—The sycamore. This beautiful tree can be grown close to the seashore, and should on the south-west

west and west part of the island receive some attention. Height, 100 feet. Wood, close-grained; used for implements, cabinet-making, and for musical instruments. The sap contains sugar. The winged seed of this and the other maples propagate willingly. Can be planted very young, and should then be planted in spring. Older plants may be planted in autumn.

(Fire-lines) - 4. *Acer rubrum.* Linné.—The red maple of North America; prefers a moist and deep soil, but suffers no stagnant water. Height, 100 feet. The foliage turns red during summer. Wood, close-grained, yellow and white; that of the older trees very beautiful, and much sought for ornamental work on account of its curled appearance. This maple yields also sugar, but only half of the sugar maple. All the maples give excellent charcoal. The seed should be sown in the most humid part of the nursery. Treatment like the others.

(High valleys) - 5. *Acer saccharinum.* Wangenheim.—The sugar maple of North America; prefers a more elevated position, but still a humid soil. One of the largest maples, 100 to 150 feet, 5 to 6 feet diameter. The wood is roseate, close and beautiful; sought for furniture, and used also by wheelwrights. When the tree in mid-winter is tapped it will yield 2 to 3 lbs. of sugar a year, and may be tapped for many years in succession without apparent injury. The bark gives a very good dye. Propagated like the other maples.

(Fire-lines) - 6. *Acer dasycarpum.* Ehrhardt.—The white maple of North America; prefers dry localities, and might in Ireland be utilised in mixture with other deciduous trees for fire-lines. Height, 50 feet. Wood, pale and soft, giving a very good timber for small farms, and excellent charcoal for export.

(Avenue) - 7. *Aesculus hippocastanum.* Linné.—The horse chestnut; prefers sandy soil, and is only mentioned here on account of its fine appearance as an avenue tree and for fire-lines. Wood, light fissile; used for furniture, and yielding a good charcoal. The bark is used for tanning. Propagated from seed and suckers.

(Fire-line) - 8. *Alnus glutinosa.* Gaertner.—The alder is eminently suited for cultivation in the boggy valleys, and to form fire-lines. Height, 60 feet. Wood, light, soft, turning red; used for all kinds of waterworks, pump-trees, &c., and gives an excellent charcoal. The bark yields a fine dye, and contains some peculiar tanning properties. Propagated both from seed and suckers or layers.

(Fire-line) - 9. *Alnus incana.* Willdenow.—The North American alder is smaller than the former, but resembles in other respects its European congener.

(Barren range) - 10. *Betula alba.* Linné.—The common birch of Europe. This hardy tree should form a valuable covering of some of the northern and exposed hills. Height, 80 feet. The wood is white and light. It is an excellent firewood. The bark is used for preparing the so-called Russian leather. Propagated from seed which may be sown broadcast in suitable localities, and mixed with fine earth on account of its extreme lightness.

11. *Betula excelsa.* Pursch.—The birch of North-East America; prefers a damp soil. Height, 90 feet. Wood, fine-grained, roseate, and well suited for farm husbandry. Bark used for tanning. The wood is also used for furniture and takes polish well. Propagated from seed.

(Ranges) - 12. *Betula papyracea.* Aiton.—The paper birch of North America; prefers a rocky and elevated position, and resists the wind well. To be utilised on the most exposed granite slopes. Height, 100 feet. Wood, finely-grained, tough, and clear in texture; used by carpenters and wheelwrights. The bark is very tough, and is used for canoes by the Indians, and for thatching, roofs made of this bark being known to have lasted for upwards 15 years. Propagated easily from the very small seed and suckers. Can be sown in the open after preparatory crop of flax.

(Fire-lines) - 13. *Carpinus betulus.* Linné.—The hornbean of Europe. This tree prefers an even and moist position, and should be used extensively in the fire-lines and outskirts, as it is extremely difficult to burn. Height, 75 feet. Wood, close-grained, tough and horny, but not elastic. Used by wheelwrights for axletrees, knaves, &c., for blocks, and where great hardness is required. It is propagated from seed, which remain one year in the ground, and from suckers and layers, and can stand transplanting in almost any age, which makes it most useful in the fire-lines, which thus easily can be kept closed. In the north-west part of Ireland should be used for the above purpose.

(Lowland) - 14. *Carya alba.* Nuttall.—The shellback hickory of North America requires a deep humid forest soil, and develops in favourable positions rapidly to a splendid tree; height, 80 feet. Wood, valuable, strong, elastic and tenacious; used much for handles, spokes, &c., as well as for hoops. This, as well as the other hickories, is propagated from the well-known hickory nut, and as they all have a strong tap root the transplanting is difficult and costly, the best way of cultivating them being, therefore, to sow them in the forest between the rows of young pines or larches, these acting as nurses, or in mixture with beech (*fagus*) or the abietineae.

(Highland) - 15. *Carya tomentosa.* Nuttall.—The white heart hickory; prefers a dry and elevated position in the forest. Height, 100 feet, with a straight and elegant trunk. Wood pale, elastic, and more durable than the former. The seed contains a great deal of oil, and varies much in size. On the hills and ranges inland, should, in mixture with other trees, fi. ex. oaks, form valuable forest.

(Fire-lines) - 16. *Carya glabra.* Torrez.—The hog nut tree of North America; prefers also a dry position. Wood, dark, elastic, tough, and durable. Height, 80 feet. Useful in mixture with *carpinus betulus* for fire-lines.

The bark of all the hickories contains several dyes, principally yellow dyes, which, by addition of alum and other ingrediences, are changed into green, olive, brown, &c.

(Fire-lines) - 17. *Juglans regia.* Linné.—The walnut tree of Europe; prefers a sheltered position and deep humid soil, and should be used for lining roads and on the fire-lines. Height, 75 feet. Wood, light, with dark heartwood, tough, elastic, and much sought for gunstocks, pianos, and furniture. The rapid destruction of this most valuable timber tree from the great forests makes it desirable to use it extensively in new cultivation; and the rise in the value of the wood, as well as the fact that it is eminently suited to the climate and soil, are more reasons why it should occupy a prominent place here.

In France a great deal is made by pressing oil of the nuts, which oil is used in medicine, and also in the preparation of artists' colours. The shells of the nuts form a black dye, and the bark is used for tanning a peculiar kind of leather. Like the caryas, it should be sown, but can stand planting better than these.

(Fire-lines) - 18. *Juglans nigra.* Linné.—The black walnut of North America requires also a good soil. Height, 70 feet, with a trunk of large dimensions and of quicker growth. Wood, purple or dark brown, strong, elastic, durable; used for fine and expensive furniture, retaining polish better than most other woods. Insects do not attack it. The seed contains more oil than that of the former. Propagation like J. regia.

(Firelines) high and dry. 19. *Juglans cineria.* Linné.—The butternut tree of North America; prefers more rocky and less rich or humid soil. Height, 50 feet. Wood, paler and not so heavy as the other walnuts, but very durable still, and resists attacks by insects. Used for panels, lining, and finering. Like the other walnuts, the bark is used for tanning and in medicine, as are the husks, leaves, and nuts.

(Water-courses) lowland. 20. *Fraxinus excelsior.* Linné.—The ash of the Old World; prefers good and humid soil on the banks of water courses. Height, 80 to 100 feet. Of quick growth; wood, pale yellow, remarkably tough and elastic; used much for agricultural implements, handles, oars, &c. The propagation from seed, which remains one year in the earth. Should be used a great deal in the lowland and along watercourses, whose banks would be made more firm by the roots of these trees.

(Fire-lines) higher up. 21. *Fraxinus Americana.* Linné.—The white ash of North America; will grow in drier locality, but succeeds still best in a humid soil. Wood of same quality as the former; might with advantage be used in the fire-lines in the south and west of the country. Like the former, can stand transplanting in almost any age.

22. *Fraxinus Oregana.* Nuttall.—Oregon ash and—

23. *Fraxinus Sambuccifolia.* Lambert.—The black ash, as well as several of the Japanese ashes, should also be tried here. It would well

repay the trouble to introduce these quick growing and valuable timber trees more extensively in the forests than has been done before.

24. *Platanus occidentalis.* Linné.—The plane tree of North America. Prefers damp or humid and even boggy soil. Should be used for lining swamps, and in mixture with ash on the watercourses, avenues, &c. Height, 60 feet, but the diameter sometimes reaching 10 to 15 feet. Wood of a red-brown colour, resists insects, and is used for furniture and cabinet-making. Propagation from seed requires some careful manipulation, but then the best plants and the best trees are obtained. From layers, suckers, and cuttings, the propagation is easier, but the trees rarely succeed so well.

(Avenues) - 25. *Platanus orientalis.* Linné.—The European plane tree; prefers drier localities, and is better suited for avenues than the former. Height, 90 feet. Quickly growing. Wood valuable for furniture.

(Borders) and (Fire-lines). 26. *Platanus racemosa.* Nuttall.—The Californian plane tree is also a fine avenue tree, and is perhaps better suited than the former for cultivation in Ireland as a border tree. It resembles the former, but is of quicker growth, and the wood tougher and more durable. Reared from seed, suckers, and layers, like the other planes, and can stand transplanting to a very high age.

(Fire-lines) - 27. *Populus tremula.* Linné.—The aspen of Europe; will grow on almost any soil in the lowlands, but does not thrive on the mountains or in rocky soil, and prefers limestone formations. Height, 90 feet. Wood, white, fissile; light and easy to work; used much for the fabrication of matches (Tändstikker), and also by coopers and joiners, as well as for ornamental work. Ground to a pulp, it is used in the manufacturing of paper. Propagation mostly from layers, suckers, and cuttings; easily obtained. These trees should be cultivated on fire-lines and along the watercourses, and being of quick growth would act well as nurse tree.

28. *Populus serotina.* Hartiz.—The Canadian poplar requires a damp soil. A large tree of rapid growth; the leaves develop very late; wood, soft and light. Utilisation the same as the former.

29. *Populus monilifera.* Aiton.—The cotton-wood of North America. Will grow on very poor soil and in very exposed positions. Care should be taken in propagating this tree to choose only the male trees, as the downy seed from the female trees affect the respiratory organs when they fly about in summer. Height, 100 feet, and of very rapid growth. Wood, light, fissile, but of a ropy tenacity, and the most durable of all the poplars. It is used a great deal for brakes. The cuttings and layers grow very willingly, and can be transplanted almost at any age.

(Fire-lines) - 30. *Populus nigra.* Linné. And 31, *Populus Pyramidalis du Roi.*—The black and the pyramid poplar. Prefer humid soil, and are of very rapid growth. Height, 120 to 150 feet. Wood, loose, light, and fissile; used much for matches.

(Lowland) - 32. *Quercus rubra.* Linné.—The red oak of North America; prefers moist forest, with a good surface and clay for subsoil. Height, 120 feet. The wood is strong and tough, though not so valuable as timber as the following oaks, but mentioned here on account of the superior quality of its bark, which is richer in tannin, containing sometimes as much as 23 per cent. This oak is here recommended for mixture with other deciduous trees, and being of comparatively rapid growth during young years may yield a good interest as low forest for bark productions with a high forest of timber trees.

(Lowland) - 33. *Quercus robur.* Linné.—The two well-known varieties, *Q. pedunculata*, Salisbury, and *Q. sessiliflora*, Ehrhardt, are both called by one vernacular, viz., The British Oak. The first variety is best known on the British Isles, and requires a rich forest soil with clay subsoil. No remarks are needed on this well-known tree, which should take a prominent part in the cultivation of a country where it in bygone days has played such a great part, and furnished most valuable timber for Northern Europe for centuries.

(Highland) - 34. *Quercus alba.*—Linné. The white oak of North America. Prefers, like most oaks, a rich forest soil, but will be content with a more rocky home, even on a granite formation, and will also resist wind pressure. Height, 80 feet. Wood very valuable, strong, durable, elastic; sought by wheelwrights, carpenters, and coopers.

35. *Quercus coccinea.* Wanginleins.—The black oak of North America reaches, on a humid and deep soil, a height 100 feet, with a diameter of 5 feet, wood dark, strong, and elastic, used for all kinds of implements. A yellow dye (Quercitron) is obtained from this tree. The bark is rich in tannin.

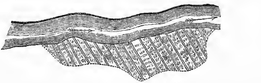
(Coast) - - 36. *Quercus Garryana.* Douglas.—One of the most northerly oaks of North America, where it grows close to the coast on even very poor granite soil. Height 100 feet, with a diameter often reaching 6 feet. Wood pale, straw coloured, hard, close grained, strong, and suited for the same purposes, as the best European oaks. The acorns are very fattening food for pigs.

The oaks are all best propagated from seed, and as they have a strong tap root, and demand good soil, as a rule, are best sown where they shall stand. Q. Garryana and Qalba had better be planted, and not too old.

37. *Salix Caprea.* Linné.—The sallow willow, of Europe, prefers like most willows, a moist position, where it will grow to a height of 40–50 feet. Wood light, fissile, but tough, and used mainly for charcoal for gunpowder, for which purpose it is being cultivated largely on the continent of Europe. It is also used for handles, &c., and the 1–2 years shoots for hoops. The bark of this willow is much sought for tanning glove skin. Propagation, like the other willows, only from layers, cuttings, stools, &c.

38. *Salix purpurea.* Linné.—The purple or red osier, and—

39. *Salix viminalis.* Linné.—The common osier of Europe should in Ireland form a very prominent feature, by the formation of osier beds on many of the river flats now nearly valueless except for grazing. Many a swampy flat liable to floods, and therefore useless for agriculture, might be turned to great account by the cultivation of this marketable article, the osier, and I have seen several small attempts on this in various parts of the country, but all on such a small scale that the results can not be very great. I must here remark that the larger the plantation, up to a certain degree, of course, the better the profit, and if anybody wishes to enter upon such an industry as osier growing, I would advise to do so on an area at least 150–200 acres as the labour of gathering, peeling, tying, &c., &c. diminishes in proportion as the area and the whole affair is larger, and a steady supply to the market can be relied upon. No willows will grow in stagnant water, and the ground should therefore be drained by drains running nearly vertically on the direction of the watercourse, so as to catch the silt, and always be full of water.



The width of the drains, and other details, depend much upon the character of the watercourse as well as upon the soil, and would occupy too much space to describe here. The demand for basket willows has been on the increase for a long while, and it is likely to increase still more. The supply for Great Britain is to the greatest extent derived from Holland and Belgium, where osier growing has flourished for a long time, and it is therefore to these countries that we must look for information about the treatment of the cultivation as well of the products. The osiers are propagated entirely from cuttings. These are put in the prepared ground, so as to cover them with about ¼-inch of soil, to produce many shoots from the cutting or stool, and in the third year the plantations will commence to yield and bear well for upwards of 10 years, when it will commence to decline slowly. Salix purpurea, being the most valuable for fine work, prefers a lighter soil near the outlet of rivers, and where there is no clay, while the Salix viminalis grows best on a heavier and richer soil. The raw material from one acre averages in some parts of Holland a value of 24 *l.*, and where so splendid opportunities are offered as in Ireland, this average should easily be reached. It is not possible to give an average of the cost of cultivation for Ireland; but I will only refer to the large willow plantations near Ultersen, in Holstein, where the average cost per acre was about 7 *l.*, including all expenses of fencing, buildings, &c. In Ireland, where so many facilities offer themselves for this work, the cost should be less, or, at any rate, not higher. To provide a great amount of cuttings of good willows, as well as for experiments with other kinds of willows, it would be practical to erect a couple of nurseries on some of the rivers; and the Shannon valley, as well as the Lough Neagh basin, offer such good opportunities that it would be a pity not to make use of them.

Of foreign willows I would recommend experiments to be made with—

40. *Salix nigra.* Marshall.—The black willow of North America;

41. *Salix Humboltiana.* Wildenow;

42. *Salix acutifolia.* Wildenow; and,

43. *Salix Daphnoides.* Villars.—On sandy soil and many others. It would be of no practical use to enter upon detailed description of this cultivation, but I hope to have said enough to convince of the great importance of this part of the question. Those who know Ireland will see the importance of it readily.

44. *Tilia Europæa.* Linné.—The lime tree of Europe. This well-known tree should be used on the firelines, and with other varieties, as :—

45. *Tilia grandifolia.* Ehrhardt, and

46. *Tilia parvifolia.* Ehrhardt,—be cultivated on roads and outskirts. The height about 100 feet, with diameters from 5–12 feet. The wood is soft, close grained, pale, and tenacious. It is used by turners and for carving. It gives very fine charcoal, and is useful by its ability to resist attacks by insects. These and,

47. *Tilia Americana.* Linné.—The basswood tree, are all easily propagated from layers as well as from seed, and can be planted out when 2–3 years old.

48. *Ulmus campestris.* Linné.—The elm of Europe. This well-known tree prefers a humid, fresh soil, and attains a very high age, and sometimes an enormous diameter. The wood is very durable, close grained, light in colour, and very tough. It is much used for gun carriages on account of this last quality, as it does not splinter when hit by a cannon ball or shell; the splinters from the wood often killing and wounding more than the ball itself.

The wood is also used by wheelwrights and carpenters, for coffins, &c. The propagation is easy from layers, cuttings, as well as from seed, which must be sown in July. If sown in autumn remains two years in the earth.

49. *Ulmus Americana.* Linné.—The white elm, a very elegant tree, of same habits as the former. Should receive some attention on account of the great dimensions of its trunk, which yields very valuable timber for building and other purposes. As the climate and soil of Ireland seem so well suited for these trees a great number may be experimented with, as for example :—

50. *Ulmus racemosa.* Thomas.—The Cork elm;

51. *Ulmus fulva.* Michawn.—The red elm, as well as the

52. *Ulmus alata.* Michawn.—The whahoo of North America.

53. *Fagus silvatica.* Linné.—The beech of Europe. This well-known forest tree is only mentioned here without entering further upon an unnecessary description of it. It should occupy a prominent place in the hardwood forest, on the slopes, and the stately growth of the large beeches at Powerscourt, near Dublin, show that this tree will grow to a great size in Ireland. But to commence the forest with this tree I consider unwise, and it would therefore first, on a later period, be cultivated here. Still it should have a place in the nurseries.

54. *Catalpa speciosa.* Ward.—An American tree, sometimes called by the vernacular "Yockmatock." This tree prefers a deep and good soil in sheltered position, but is here of most rapid growth. Height 50–75 feet. Diameter 3–4 feet. The wood is light, fissile, and loose, but, still, one of the most durable for all exposed work, as sleepers, posts, rails, &c. According to Mr. Barney, of Ohio, posts made of this wood have been known to have lasted for upwards of 100 years. This tree has, according to Dr. Poulsen, of Copenhagen, been found very hardy even in Denmark. It is easily reared from seed, which require 12 hours steeping in warm water before sowing, and covered with ¼ to ½ inch light soil. Transplant when two years old, and should be planted very close, or in mixture with other quickly growing deciduous trees, pilex larch, poplar, &c.

OF SHRUBS,

I will here mention—

1. *Corylus avelana.* Linné.—The hazel of North Europe.

2. *Corylus colurna.* Linné.—The Turkish hazel, which together with other hazels should be introduced to form coppice wood, together with oak. Propagated from seed.

3. *Rhamnus frangula.* Linné; and,

4. *Rhamnus infectoria.* Linné.—Both blackthorns, producing a fine and valuable charcoal, and the bark a good dye.

5. *Cratægus oxyacantha.* Linné.—The well-known hawthorn;
6. *Cratægus crus-galli.* Linné.—The cockspur thorn;
7. *Cratægus parvifolia.* Aston.—The long-spiked thorn; and,
8. *Cratægus tomentosa.* Linné.—All North American hawthorns, useful for hedges and enclosures, and for protection of young plants, should not be omitted here.

In concluding this list of trees and shrubs proposed to cultivate in Ireland, I do so with the remark that the very short remark on each kind has only been made with the view of showing how and where each should be utilised, and in the hope that it may be sufficient to procure for each the place in the forest flora which it deserves; as well as to prove what an immense advantage the cultivation of these trees would prove to Ireland and to the whole of Great Britain.

That a more detailed and professional description of each will be necessary for each district I am fully aware of, if experienced foresters are not to be engaged for this work.

Copenhagen, 1884. (signed) *D. Rowitz,*
Forest Conservator.